International Council for the Exploration of the Sea

C.M. 1980/G:32
Demersal Fish Committee

" Relationships between depth and age, and recruitment indexes of hake on Galicia and Portugal shelf "

by

F.J. Pereiro, (1) A. Fernandez (2) and S. Iglesias (1)

ABSTRACT

In this paper it is studied the relations between the depth and the ages of the hake caugth in the six surveys done between 1974 and 1979 in the Divisions VIIIc and IXa, as soon as the recruitment levels in those years. It is observed a clear stratification of the ages and a significant bathimetric tendency to increase the mean age with the depth (r=o.81). On the other hand, it is noticed a serious decrease in the following years over the recruitment level detected in 1974.

RESUME

Dans ce papier on a studié les relations entre l'âge et la profundeur du merlu capturée pendant six campagns realisées entre 1974 et 1979 dans subaire VIIIc et Division IXa du CIEM ainsi que les niveaux du recruitment durant ces années.

On observe une claire stratification entre la bathymetrie et l'âge et une tendence significatif a augmenter l'âge

.....

(1) Laboratorio Oceanográfico. Orillamar 47.Vigo. España (Spain)

(2) Laboratorio Oceanográfico. Muelle de Animas. La Coruña.España (Spain

moyènne avec la profunder (r=o.81). D'antre coté, on constate une grave chute dans les annecés suivantes un relation avec le niveaux de recruitement detecté en 1974.

INTRODUCTION

The last meetings of the Hake Working Group had considered two stocks of european hake (Merluccius merluccius L.) called "Northern Stock" (Areas IV-VI-VII and divisions VIII ab), and "Southern Stock" (Divisions VIIIc and IXa). The present paper is refered to the "Southern Stock", mainly to the Galician shelf area (NW of Spain).

This Work presents two diferent parts, the first one refers to the bathimetric stratification of the ages, trying, to analise quantitatively the so known tendence to catch bigger individuals when the depth increase. The second one is reported to the tendences of the recruitment of the last years (1974-1979). In the last reports of the Hake Working Group (Anon. 1979and 198o) and in other papers about this stock (A. Fernandez et al. 1978) references are noticed about a strong decrease of the recruitment in this area, considered in the aforementioned papers, as one of the most important nurseries of the european hake together with the Grande Vasiere. This fact lead us to think in a serious danger recruitment overfishing and this is why it was seen the neccesity to elaborate and compare with the available data of the surveys done in the last years , the indexes of recruitment that come it out.

MATERIAL AND METHODS

To carry out this objetives, we have utilized the results of the surveys made by the Galician Laboratories of the IEO with the R/V Cornide de Saavedra in the area and periods that are the following

.....

Survey	Month	Area
"Merluza NW 74"	August-74	Galicia
"Merluza NW 75"	May-Jun 75	"
"Acustica Demersales NW 76"	May- 76	"
"Demersales NW 77"	September-77	"
"Selectividad 79"	April-79	"
"Selectividad 79-bis"	June-79	"
"Cigala 79 Division IXa	August-79	Division IXa

The R/V Cornide de Saavedra is a stern trawl with 1oooGTR and two engines with 625 HP each other.

The fishing gear used , was the "baka" type, and all the hauls made and cited in this paper were the provide with cover of 2o mm. mesh size, in order to obtain an unbiased image of the structure of the population.

All the hauls lasted one hour and the ones that for different ressons were not of that duration, were weighted at that time of trawling. For bathimetric and ageing studies there were used 171 hauls in total, betwee 7o and 65o meters depth. To accomplish this purpose, it was not used the survey of 1974 because all the hauls were carry out between 1oo and 2oo meters depth.

To obtain recruitment indexes there were used the 85 hauls realiced betwee May and September in less than 2oo meters depth. It was done in this Way because recruitment can be considered as completed and because in more than 2oo meters hardly appear hake of age class O in the catches and the number of hauls in bigger depth would bias the recruitment indexes making them uncomparables. All the individuals of hake caught were measured to the centimeter below , and we take foom each haul the length size composition in the codend and cover all together.

The hauls of each survey were grouped by depth strata (less than 1oo, 1oo-15o, 15o-2oo, 2oo-25o, 25o-3oo and more than 3oo meters) arriving by this way to the length composition by survey and stratum of depth in classes of one centimeter. To the year 1979 where tree surveys were realized, were added the results obtained in Galician Waters and it was considered separately the survey "Cigala79" because it included all the Division IXa by a stratified random sampling.

Those length distributions, were transformed to the age distributions, by the growth equation adopted by the Hake Working Group (Anon.1980) With the parameters K=0.12. to= -0.48, Linf.= 98 cm. separeting the ages by the nearest centimeters to the limits of the each age class. This distribution were transformed in percentages.

Finally it was applied the linear regression and correlation technique to the different variables, that is to say, real mean depth and mean age of the hauls made each year in each stratum and mean age of the hake caught.

As the recruitment indexes, the number of individuals of age class 0 (smaller than 17 centimeters) caught in one hour trawl in the hauls realiced in less than 200 meters were considered, and the best individuals hauls of each year were taken in order to compare them to the maximun values obtained each year.

This was also made to each important recruitment area separately.

RESULTS

1.- Bathimetric stratification of the ages

In the figure 1 are shown the histogram of the age distributions (in %) of the catches by depth stratum in the different surveys.

It is observed that before 200 meters the most abundant fish are the age class 0 and ages older than tree years hardly appear at this smaller depths. The resulting mean age is 1.2 years old.

Between 200 and 300 meters appears something like a transition zone where individuals of age class 0 decrease notably and the ages to five years are already represented, resulting 2.1 mean age, between 200 and 250 meters, and 3.4 mean age between 250 and 300 m.

Finally, in more than 300 meters depth it does not appear a single individual of age class 0 and hardly of age class I , but the individuals of the oldest ages that were caught by trawl in this stock wit the actual exploitation pattern (age class V-VI-VII and VIII) are well represented resulting a mean age of 4.9 years old for this stratum.

Table 1 provides the mean ages obteined to each stratum and survey. Even so age distribution depend on the state of explotation of the stock, the image gives: a clear tendency between the both compared variables.

IN figure 2 are represented the points , real mean depth and mean age, and the corresponding regression line . The correlation coefficient obtained is o.8o59.

RECRUITMENT INDEXES

In table 2 are expresed the recruitment indexes obtained each year in number of hakes of age class 0 caught by trawl hour, and the biggest values reached each year.

In table 3 are given the indexes of the most important recruitment located areas , in the same units to each one.

In all the cases it is observed a strong decrease in all the years after 1974 compared to this one. This big differences can be explained by two reasons: either the year 1974 was exceptionally good,(and there is not information confirming it), and the following ones were more or less normals or it was a strong decrease of the recruitment after 1974 or probabl before. Others works (Lopez Veiga et al. 1978) show that comparing 1973 it was produced a decrease, and analysing the length distributions in the catches of the last years (Anon. 1979-198o) a great decrease of the smallest individuals (less than 25 centimeters) in these years can be pointed out. All of it is in agreement with the informations of the ports in the sense of a tremendons breakdown in the catches of the "carioca" (hake of unlegal length, that are sold with that name) in relation to the years before 1973.

Therefore , all the available information senses to clearly indicate that this stock is in a serious danger of recruitment overfishing caused whitout any doubt by the explotation pattern employed during many years (4o mm mesh size and less in the codend of the trawlers and high level of fishing effort) that generated fishing mortalities in the orde of 1.23 in age class I (Fernandez et al. 1977-1978) and could have poduced along the years and excessive decrease in the spawning stock.

In figure 3 appeared located the recruitment areas found in the surveys.

CONCLUSIONS

1. The hake age group 0 and their recruitment to the area are localize until 2oo-25o meters depth.

2. Rarely appear hake with 4 or more years old at dept smaller than 2oo meters in this southern stock.

3. At depth higher than 3oo meters the age class 0 disappear and hardly are found individuals of age class I .

4. Hake bigger than 4 years old are significatively abundant at depth greater than 25o-3oo meters.

5. According to the formar 4 points it can be said that there is a clear relationship between the depth and the mean age of hake caught during 6 cruises from the period of 1975-1979 with a correlation coefficient of o.81.

6. Therefore, it seems to exist a migration of hake during its life to greater depth.

7. After 1974 dangerous failure in the recruitment levels on the Galician "nurseries" in relation with that year could be detected falling dawn fron more than 1ooo individuals of age-group 0 for hour in 1974 until 1oo-2oo individuals in the susequent years.

8. That implies serious risk of recruitment overfishing likely due to the bad exploitation pattern at which the stock has been submitted along many years.

9. In agreement with points 7 and 8 there is a pressing med to undertake regulation measure (including mesh and effort changes) in order to get a recovery of this southern stock.

REFERENCES

Anon. 1979 - Report of the Working Group on Assesment of Hake Stocks (Charlottenlund, 28-31 May 1979). Cons. Int. Explor. Mer, C.M. 1979/G:27

Anon. 1980 - Report of the Working Group on Assesment of Hake Stocks (Copenhage, 12-17 May 1980). Cons. Int. Explor. Mer, C.M. 1980/G:27

Cushing D.H.- Upper trophic levels in upwelling areas Reprint from Upwelling Ecosystems

Fernandez, A.,Pereiro, F.J., Iglesias, S., Porteiro,C., and Pallarés P. - 1978. La pesqueria demersal gallega. Estrategias de pesca para su regulación racional con base a la merluza. Bol. Inst. Esp. Ocean. nº 249 .

Fernandez, A., Iglesias S., Pereiro F.J. and Garcia J.M. 1977 . On the hake population dynamics from Galicia (NW Spain) with a preliminary assesment . C.M. 1977/G:9

Lopez Veiga E.C., Vazquez A., Labarta E., Alonso-Allende J.M., Fuertes J.R. Perez-Gandaras,G., Touron J. - 1977 . La pesqueria de merluza de Galicia. Estudio de la distribución de juveniles y análisis de rendimientos. Inf. Tec. Inst. Inv. Pesq. nº42

Robles R. , Pereiro J.A. , Fernandez A.M., Garcia J.M., Lens S. 1975 . Estudios de cartografia, selectividad y marcado de merluza europea (Merluccius merluccius L.) frente al litoral gallego Bol. Inst. Esp. Ocean. nº 19o

Deep (meters)	50-100	100-150	150-200	200-250	250-300	+ 300
Year						
1975	1.76	0.78	0.57	0.98	3.32	6.64
1976		0.42	0.35	3.59		
1977	0.97	0.92	3.03	2.85	3.30	3.88
1979-Galicia	0.87	1.58	1.28	2.10	3.41	4.62
1979-Division IX a	1.54	1.36	1.32	2.35	3.37	4.30

Table 1.- Mean age-by-depth and year

Year	1974	1975	1976	1977	1979
Mean Index	1152	198	254	96	158
Higher value	4552	1027	1094	662	326

Table 2.- Recruitment Index by year, as number of fishes at age 0 by 1 hour haul.

Ground \ Year	1974	1975	1976	1977	1979
Estaca-Ribadeo	1217	150			
Prior	1582	444			157
Sisargas	1389	508	58	32	
Toriñana	1934	288	234	11	
Finisterre-Corrubedo	170	17	74	41	

Table 3.- Recruitment index by nursery ground and year.

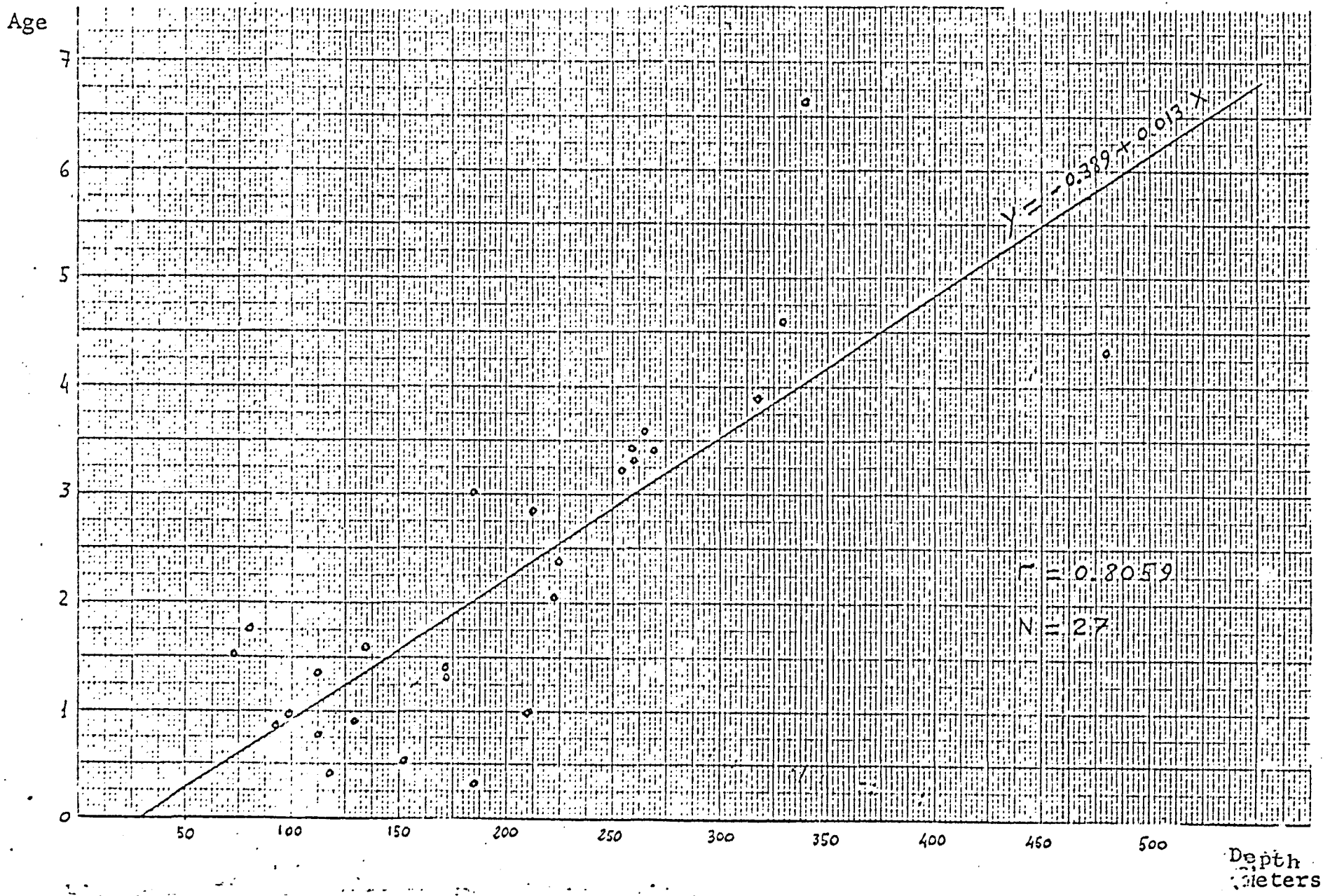


Figure 2 .- Depth and mean age of hake regresion

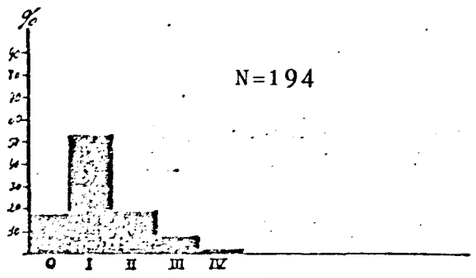
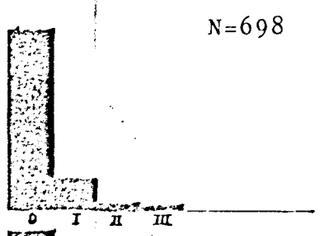
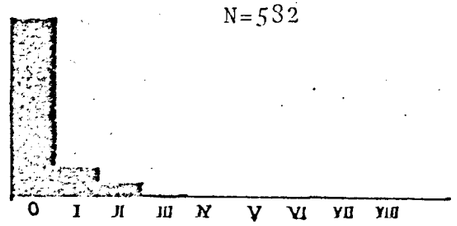
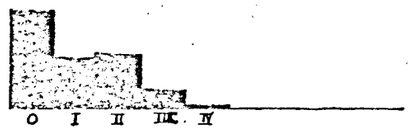
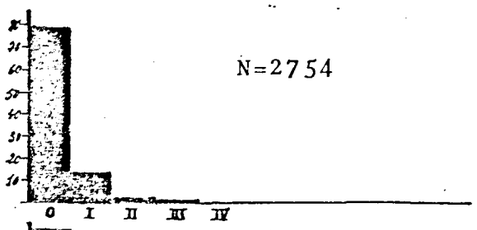
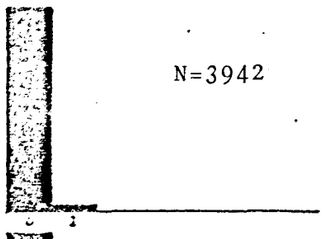
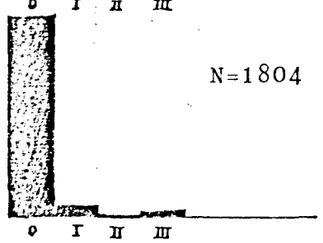
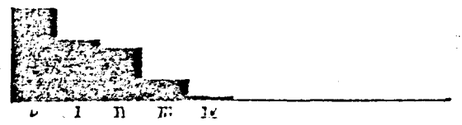
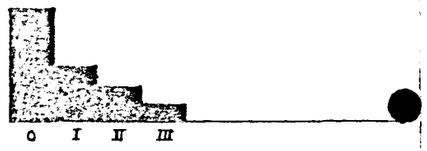
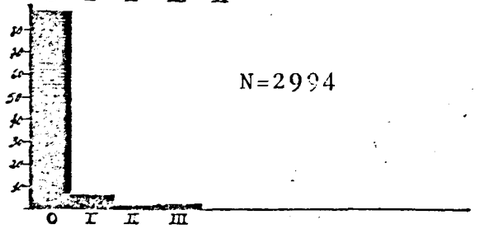
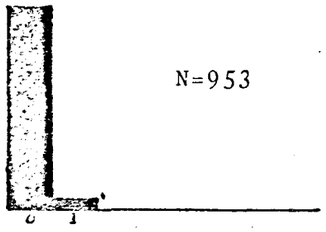
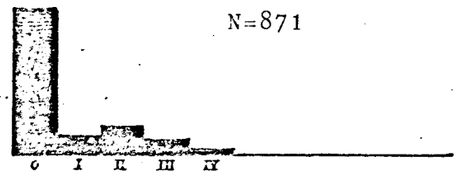
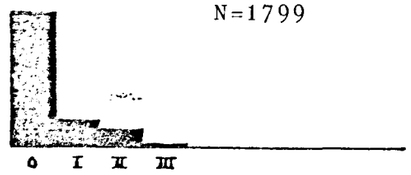
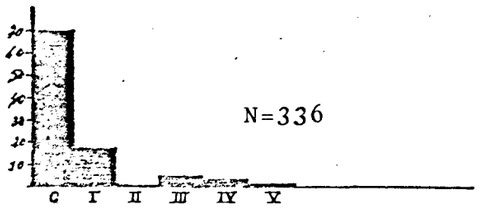
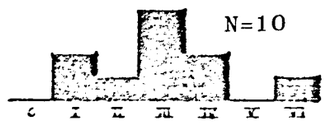
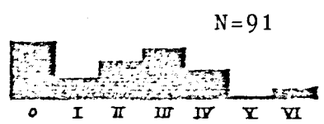
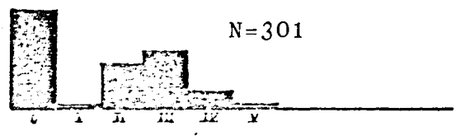
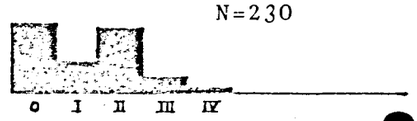
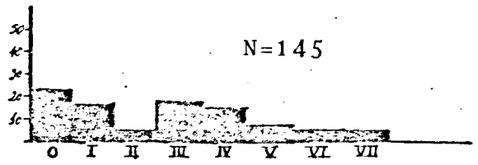
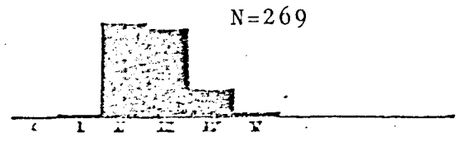
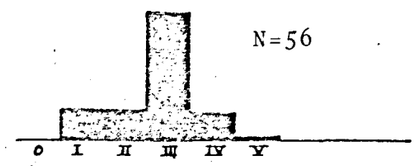
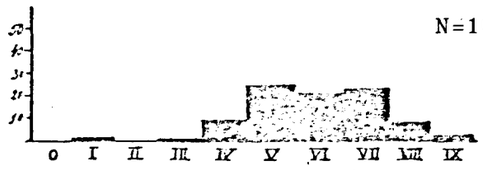
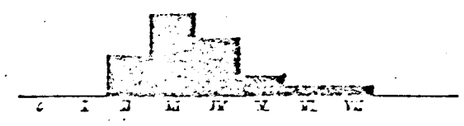
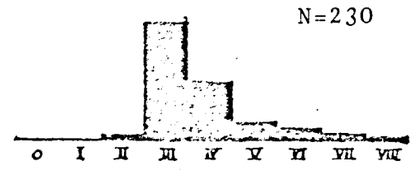
SURVEY	"MERLUZA NW 75"	"ACUSTICA DEMERSALES NW 76"	"DEMERSALES NW 77"	"GALICIA SURVEYS 79"	"CIGALA 79 DIVISION IXa"
Meters depth					
- 100	 N=194		 N=698	 N=582	 N=1639
100-150	 N=2754	 N=3942	 N=1804	 N=1179	 N=2442
150-200	 N=2994	 N=953	 N=220	 N=871	 N=1799
200-250	 N=336	 N=10	 N=91	 N=301	 N=230
250-300	 N=145		 N=36	 N=269	 N=56
+ 300	 N=107		 N=64	 N=43	 N=230

Figure 1.- Age composition by depth and survey.

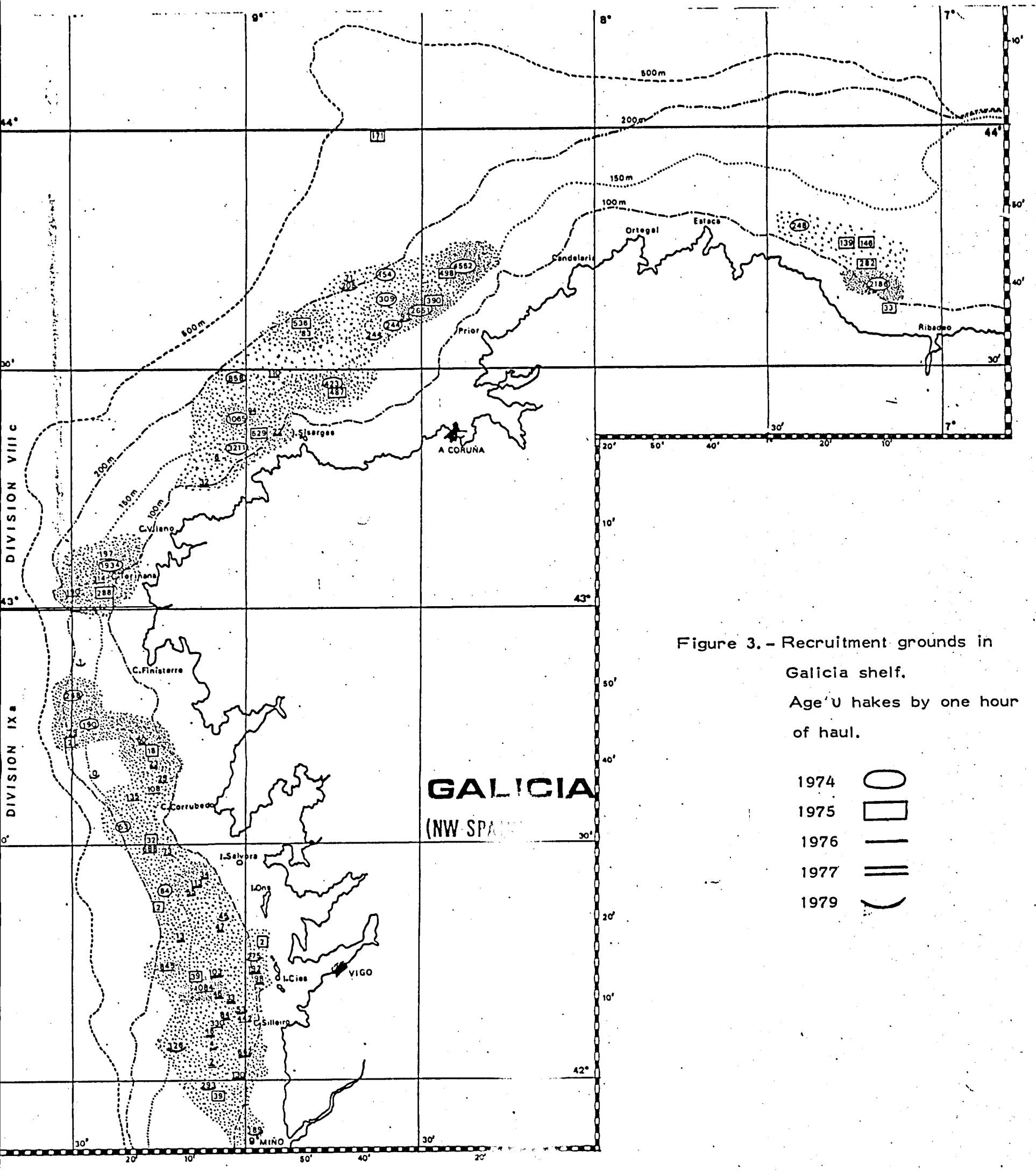


Figure 3.- Recruitment grounds in Galicia shelf.
Age 0 hakes by one hour of haul.

1974
1975
1976
1977
1979